Journal of the Society of Arts.

FRIDAY, MARCH 8, 1867.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at Eight o'Clock:—

MARCH 13.—"On the Tinnevelly Pearl Fisheries." By CLEMENTS R. MARKHAM, Esq.

MARCH 20.—"On Successful Oyster Culture." By HARRY LOBB, Esq.

CANTOR LECTURES.

A Course of Lectures "On Music and Musical Instruments," by JOHN HULLAH, Esq., is now being delivered as follows:—

LECTURE II.—MONDAY, MARCH 11.

MELODY.—Musical System—Tonality, Ancient and Modern—The Subdominant and Leading Note—Melodies in Imperfect Scales and in Ancient Modes.

LECTURE III.—MONDAY, MARCH 18.

MUSICAL EXPRESSION. — Definition — Difficulties of Musical Composition—Realization of Unheard Effects —The Perfect Cadence—The Renaissance—Imitation—Expression, False and True.

LECTURE IV.—MONDAY, MARCH 25.

MUSICAL NOTATION.—Different Systems, Alphabetical and Special—Neumas—Accents—Lines and Spaces —The Time Table—Modern Notation; its Origin and Growth, Simplicity and Fitness.

LECTURE V.—MONDAY, APRIL 1.

MUSICAL INSTRUMENTS.—Classification—Wind Instruments—Stringed Instruments—The Plectrum, Hammer, and Bow—Instruments of the Ancients—Mediæval Instruments; their Introduction into the Church.

LECTURE VI.—MONDAY, APRIL 8.

MUSICAL INSTRUMENTS (*continued*).—Modern Instruments—Chamber and Orchestral—Combination — The Modern Orchestra—Conclusion.

The lectures commence each evening at eight o'clock, and are open to members, each of whom has the privilege of introducing one friend to each lecture. A set of tickets for this purpose has been sent to each member.

EXAMINATIONS, 1867.

In addition to the prizes announced in the Programme of Examinations, the following are offered:—

The Worshipful Company of Coach and Coach Harness Makers offer a prize of £3 in Freehand Drawing, and a prize of £2 in Practical Mechanics, to the candidates who, being employed in the coachmaking trade, obtain the highest number of marks, with a certificate, in those subjects respectively.

The Worshipful Company of Goldsmiths offer three prizes—of £5, £3, and £2 respectively—to the three candidates who, being employed on works in the precious metals in any part of the United Kingdom, shall obtain from the examiners the first, second, and next highest number of marks, such prizes to be distinguished as the "Goldsmiths' Company's Prizes."

INSTITUTIONS.

The following Institution has been received into Union since the last announcement:—

Rugby Institute.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

FOOD COMMITTEE.

The Sub-Committee on Meat Supply met at 10·30 a.m. on Wednesday, the 27th February. Present:—The Right Hon. H. A. Bruce, M.P. (Chairman), Mr. C. S. Read, M.P., Mr. Harry Chester, Mr. Benjamin Shaw, Mr. Edward Wilson, and Mr. James T. Ware.

Dr. THUDICHUM having attended at the request of the Committee,

Mr. SHAW said at the last meeting of the Sub-Committee they had had laid before them specimens of meats and other forms of food preserved and prepared under different processes. It was felt by the Committee that they could come to no practical conclusion as to the relative value of those meats, in the absence of information with regard to their nutritive qualities and their adaptability to dietaries upon a large scale. The Committee were, therefore, desirous of hearing the opinion of Dr. Thudichum on these points, previous to considering how far they would be justified in recommending to the Government, or any other public body, that experiments should be made in some of the large public establishments with these forms of preserved meats, either as an entire or partial article of diet.

Mr. CHESTER said on the last occasion the Committee had before them specimens of raw meat from South America, preserved by Dr. Morgan's process, also by the paraffin process of Professor Redwood; but the Committee did not at present see that in either of those specimens there was a complete substitute for such meat as was required for the food of the people in this country. They had also before them a specimen of Dr. Hassall's flour of meat, which might be a very useful diet under certain circumstances, but was hardly a form of preparation that could be employed when meat was to be brought to this country from such distances as Australia and South America. The Committee also had before them specimens of Dr. Liebig's *Extractum carnis*. They thought that was a good thing as far as it went, but they wished to ascertain from scientific opinions how far they were justified in recommending experiments to be made upon these foods, on a large scale, in any of the public establishments. Possibly experiments might be tried in the Navy by feeding the crews of the vessels on

this *Extractum carnis* in connection with salt meat. In this way it might be ascertained whether the nutritive properties, of which salted meat was said to be deprived, could be compensated by the partial use of the *Extractum carnis*. The Committee would be glad to have the opinion of Dr. Thudichum on these various scientific points.

Dr. Thudichum—Allow me, in the first place, to make a distinction between extract of meat and meat itself. Extract of meat lacks the essential properties of nutriment. There is, I know, a very prevalent but erroneous opinion that extracts of meat, particularly that prepared on Dr. Liebig's plan, are nutritious. Of course, before I go further with that, I must define the term "nutriment." We know that the body wants in every twenty-four hours a given quantity of carbon, nitrogen, oxygen, hydrogen, phosphates, &c. Now, whereas Liebig's extract of meat contains these elements only in very small quantities, and that mostly in an oxydised condition, it is clear that any practical amount of Liebig's extract would not nourish in the least. Hence this extract, or any similar extract, cannot be called "food." We have to look upon extracts of meat simply as stimulants. Tea and coffee will not nourish a man; but both tea and coffee are strong stimulants of the nerves of the heart and the brain; and it is likely, I think, that the extracts of meat contain a substance which is somewhat similar in its effects to these stimulants. It may contain other substances which we do not know about, but the universal use of decoctions of meat, such as beef-tea, is only to be regarded in the same light as the habit of drinking tea or coffee. These are liquids containing an amount of nervous stimulant, and in that sense only Liebig's extract of meat must be considered. That is the view which I believe Liebig himself takes of his extract. He does not regard it as nutritive; on the contrary, he says it is astonishing that any liquid matter containing so small an amount of solid substance as broth should be by universal consent taken as a restorative, or for some purpose which we cannot define. If the Committee desire to know whether I should recommend them to have experiments made upon the extract of meat of Liebig (which in fact is nothing but condensed beef-tea), I must answer that I do not see that any experiments are necessary, unless they wish to open the entire question what is the sense of our drinking beef-tea or drinking broth.

The Chairman—What would be the difference of effect produced by drinking a cup of beef-tea and a cup of tea?

Dr. Thudichum—The effects of tea and beef-tea are, perhaps, rather analogous, though dependent upon different chemical agents. The effect of tea would be mainly due to the theine which it contains, and would consist in an acceleration of the heart's action, and greater vivacity of the mental powers. A similar effect would be produced by beef-tea, but not so much through its influence upon the heart as through its influence upon the nerves of taste and digestion, and upon the muscular sense, or sense of strength.

Mr. Chester—We are now dealing with the subject of meat. You say, as I understand, that the extract of meat is not nutritive?

Dr. Thudichum—There is so little nutriment, that if you dissolve a teaspoonful of the extract in a cup of water, and drink it, you would not receive so much nutriment as you would derive from a single mouthful of meat.

The Chairman—Then is the practice of giving beef tea to delicate children and sick persons altogether a mistake?

Dr. Thudichum—That I do not say. It seems to have an important effect, but the effect is not in the sense of nutriment. It is due to the specific effects of certain ingredients contained in it, especially creatine, the action of which, in some degree, resembles that of *theobromine*, found in cocoa. The creatine, which when in the system is changed into creatinine, has, perhaps, an action upon the heart, and upon the muscles, of which it is a constituent. Then we have in beef tea potassium salts, which the body requires for the production of muscular power. Potash is as essential an element in the chemistry of the muscles as in that of the blood. The chemical substances carried by the blood cannot pass into the muscles without the assistance of the potassium salts. Then there are contained in beef tea certain acids, of which lactic acid is one, and inosic acid another. If we look at the history of food among men, we find they have at all times made provision for acids in their food. The ancient Romans were acquainted with *sauerkraut*, or fermented cabbage. In Prussia and many parts of Germany they have a food made of fermented beans; and in Holland and many parts of southern Europe they have a preparation of fermented cucumbers; and many other vegetables are used in an acid state. This cabbage, or *sauerkraut*, is a strong acid, and so with the beans. These various foods contain lactic acid. This acid, or one identical with it in composition, though differing slightly in other properties, para-lactic acid, is contained in meat. There is no question that the fine flavour of meat—the *osmazome*—which provokes appetite, is due, in part, to the action of this lactic acid. If there is an absence of flavour in any kind of meat, lactic acid, if mixed with the gravy during preparation, acts as a substitute, and produces a relishing flavour. We find, besides, that lactic acid is useful for digestion. Then we have another acid, in various kinds of meat, called inosic acid; of that the properties are not well known. I have no doubt it has a similar action to lactic acid. Beyond that there are indefinable matters in beef tea, or extract of meat, of which we cannot say that they are not useful, but we know little of their effects. We have, therefore, as far as our present knowledge goes, to rely for an explanation of the efficiency of beef-tea upon these principles—viz.:—Creatine, or creatinine, para-lactic acid, inosic acid, inosite and potassium salts. Which of these are essential, and which not, we cannot at present tell. When extract of meat is mixed with water for use the solution should not be too strong. It is a common error, in making beef-tea, to put in an extra dose of this extract, but that is a mistake. Too strong a solution of extract of meat is as bad as too strong tea or coffee.

Mr. Shaw—Are there not carbonaceous matters in beef tea?

Dr. Thudichum—All these preparations contain carbon, but that carbon does not form food in the sense of the carbon in albumen, fat, or starch.

The Chairman—These preparations, then, you admit to be useful as aids to digestion, if they have not the necessary nutriment for the proper sustentation of the human frame. Salt meat being an imperfect food, may I ask you whether this extract of meat would form a complement to that?

Dr. Thudichum—I do not think so, because salt meat has been deprived of a certain amount of albumen. I think, however, the loss of nutritious value from salting meat is not very great on the whole. The deleterious effects of the long use of salt meat seem to be due to the effect of the excess of chloride of sodium.

Mr. Ware—What nutritive qualities are there in meat itself which the extract does not contain?

Dr. Thudichum—In fresh meat there is albumen, which is very nutritive in this sense, that it supplies the material which is necessary for the production of all the organs of the body. It is also useful in supplying heat, but not so much so as other constituents. We cannot build up the muscles, or the blood, or the eyes, or any other part of the body, without albumen. Next we have muscular fibrine, also termed syntonine. When we mince meat, and extract the albumen by means of water, there remains this syntonine undissolved, but when mixed with dilute acids it becomes a thin jelly, and is afterwards dissolved. Next we have myochrome—that is the

colouring matter contained in the muscles—and this is identical, in chemical composition, with the colouring matter contained in the blood.

The CHAIRMAN—Is that an essential element?

Dr. THUDICHUM—Yes, it acts in the breathing of the muscles during life, and for some time after death. As long as meat is in an eatable condition, this matter remains, so to say, alive; it takes up oxygen, and oxydises the noxious products of the spontaneous decay of albumen, giving out carbonic acid. Hence a butcher takes care to let his meat "breathe." If the meat were shut up close after being killed, it would become putrified in a few hours. This myochrome is a compound body, containing a quantity of iron. It is dissolved with the albumen, and precipitated with it during boiling. Besides albumen, syntonine, and myochrome, meat contains a very little gelatine, which, in the shape of connective tissue, binds together the muscular fibres. When you stew meat a long time the gelatine is dissolved, and you have nothing remaining but a bundle of hard fibres. Then we have the other substances I enumerated before as ingredients of beef tea, viz., creatine and lactic and inosic acids, potassium salts, and finally we have a brown syrupy matter, which is not more definable at present. I have already mentioned inosite, a kind of sugar, met with in French beans, as being also contained in muscle. There is another similar substance, sometimes contained in muscle, and that is animal dextrine or hepatin, or glycogenic substance from the liver. But this ingredient varies in a manner which is as yet unexplained. Sometimes, in working up half a hundredweight of meat, the chemist may get a pound of this matter, at others he may not obtain a trace. Now, when beef tea is made, the albumen and myochrome of the meat are made insoluble by boiling; the syntonine also remains undissolved; the fat fuses, and of the gelatine a small portion is dissolved. After straining there is nothing left in beef tea but inosite, creatine, creatinine, lactic and inosic acids, and potassium salts, and the brown syrupy matter. In case hepatic glycogen was present, this also would be contained in the beef tea. But I imagine that such glycogen would not remain in the extract as prepared by Liebig's company, for during evaporation this dextrine forms skins on the surface, like the skins on milk, which have to be removed, as they prevent evaporation. Liebig's extract would therefore probably never contain glycogen or animal dextrine, while fresh beef tea might sometimes contain it. It might perhaps yield the material for the change which is known as the "turning sour" of beef tea. I may add that meat contains 75 per cent. of water, and 25 per cent. of solids or residue after drying. Of these 25 per cent., 15 to 18 are insoluble in water, 7 to 10 soluble in water; but of these 4 to 4½ become again insoluble by boiling, so that it is not far wrong to say that only from 3 to 5½ out of 25, or from one-eighth to one-fifth of the whole of the solid constituents of meat pass into extract or beef tea. From four-fifths to seven-eighths of the solids are rejected.

The CHAIRMAN—Do you look upon meat as essential to human food?

Dr. THUDICHUM—Certainly.

The CHAIRMAN—If this be so, how is it that the ox, which grows so fat and strong, and which furnishes the richest meat, feeds entirely upon vegetable food?

Dr. THUDICHUM—Briefly, the ox has a different masticating and digestive apparatus from those of man. The food which the ox takes contains all the elements of the food on which we live. If we analyse grass we find it contains albumen and other compounds from which blood can be made. The stalks, leaves, and seeds contain all the ingredients which the body wants for living, particularly one essential matter called cerebric acid, which is the highest organic compound known. That is contained particularly in grain seeds, especially in indian-corn; eggs also contain it.

Mr. WARE—Chemically, there is no difference between vegetable albumen and the animal albumen on which man feeds?

Dr. THUDICHUM—They have the same percentage composition, though perhaps not the same atomic weight. We find cerebric acid, which forms brain matter, has an atomic weight of 2,007; fibrine, about 2,000; albumen, 1,608; and caseine, 807. Vegetable albumen might differ from animal, as caseine does from albumen.

Mr. SHAW—While these substances differ so little chemically, and yet their effects upon the frame are so different, does this not show that there is something in the question worthy of further experiment, and that chemical analysis is hardly trustworthy as to the effects of these matters upon the human frame?

Dr. THUDICHUM—With regard to the custom of drinking beef tea, there is much to be inquired into.

The CHAIRMAN—Following up what I have asked you with regard to the ox, it is clear we have not got the apparatus for converting vegetable food into what we require as the ox has.

Dr. THUDICHUM—No.

The CHAIRMAN—With regard to vegetarians; in what respect do you consider their diet to be deficient?

Dr. THUDICHUM—We can easily adopt a diet of vegetables only which will fully support our body, even in the wear and tear of London life. The vegetarians, here and in America, are a small example of the people in the world who live upon vegetable food. The Japanese as a people eat no meat, but in that country the cultivation of food seed plants has reached the highest point of perfection. It is by the use of seed plants especially that man is enabled entirely to do without animal food; as the organic functions of the plants attain the highest perfection, the seed is formed which contains all the essential elements of food. In this country there are great numbers of people who chiefly subsist upon vegetable food, in the form of bread. The Shakers, the Japanese, and many other peoples in different parts of the world, are practically vegetable feeders, and there is no difficulty in explaining how they manage to keep their bodies at the same weight and strength, and perform all the functions of life. There are some seeds which contain a large quantity of fibrine, albumen, caseine, and other ingredients, besides oil, acids, and starches. There is, for instance, Indian corn; that is remarkably adapted to the maintenance of the body. Then, again, we have the bean fruits; but they do not grow well in this country, because the heat is not sufficient; but beans in the warmer climate of the south are a magnificent food, and too much neglected in this country. Then, in addition, there are peas, lentils, and millet seed. These, taken together, will fully feed a man.

The CHAIRMAN—He must take a large bulk of such food?

Dr. THUDICHUM—No doubt. It is the advantage of meat that it supplies food in the smallest compass, and is dissolved early in the digestive canal. Vegetable food requires more digestion. Hence, the carnivorous animal has a short intestine, the herbivorous a long one. The house cat has gradually had its intestine lengthened, to adapt it to the digestion of bread and potatoes, and in exactly the same manner is the intestine of human vegetarians lengthened and widened to accommodate the greater bulk of their food. If sufficiently fed, vegetarians become big-bellied.

Mr. CHESTER—Are beans, lentils, and such food, easy of digestion?

Dr. THUDICHUM—There you have touched upon a difficulty in their use; these seeds require careful preparation. If not properly prepared, they pass through the stomach undigested. That is the main objection to the use of grain foods by the common people. They have neither the knowledge nor the means of properly cooking such food; therefore, practically, there is nothing like bread for them. It is soft; it is that which gives them the least trouble; it is most easily digested, and no other grain food can enter into competition with it.

Mr. CHESTER—What the Committee want to know is, what it is necessary to add to the *Extractum carnis* to give it the nourishing properties of meat, the supply of which is so deficient.

Dr. THUDICHUM—If you add eggs to beef tea you produce an equivalent, in a nutritive sense, to meat. That would make up fully for the loss sustained by the solid materials being rejected. You might also boil beans with the extractum, or add peas, lentils, or millet. Practically, it would be best to boil these seeds in soft water, or in water made soft by the addition of a crystal of soda, a sufficient length of time, and to add the extractum at the end of the boiling, just before serving. Seed one year old only should be used; seed two years old is not good. By such means beef tea or extractum may be made equally nutritive to meat.

Mr. SHAW—Have we not now arrived at a point at which experiments with regard to dietaries might be made with the *Extractum carnis* and the seed vegetables which Dr. Thudichum has spoken of?

The CHAIRMAN—No doubt experiments of this kind might be made, but I doubt whether these vegetables could be got in sufficient quantity, or at sufficiently low price, to form a staple article of food in this country. Is Indian corn equally nutritive in its young and soft state as in its hard and ripened condition?

Dr. THUDICHUM—No; in its young and soft state it has not one-fourth the amount of solid substance which it possesses in its ripe state.

Mr. CHESTER—Is it possible to preserve albumen for any length of time?

Dr. THUDICHUM—Albumen, when kept from the air, may be preserved for a long time. We can preserve it in eggs for a year or two; but though it may remain unchanged in its essential properties, it loses its appetizing qualities. That is the difficulty with preserved foods, that though apparently in a good state of preservation, they lose the qualities which make them acceptable to appetite.

Mr. E. WILSON—Would not these qualities be restored by the addition of appetizing condiments?

Dr. THUDICHUM—To a great extent, no doubt; but that presupposes a knowledge of the art of cookery. As the common people do not know how properly to cook the simplest thing, they would not succeed in imparting appetizing qualities to preserved food materials.

Mr. SHAW—Is it your opinion that the theory of cooking should be taught in schools, and perfected by practice afterwards?

Dr. THUDICHUM—I would let the theory of cooking enter into the teaching of the schools, and that would open the minds of the children to the fact that cooking is one of the most essential things to be learnt.

Mr. SHAW—I have mentioned this matter in connection with the educational examinations of the Society of Arts, but the opinion generally expressed was that cooking could not be properly taught apart from actual practice.

Mr. CHESTER—I assisted in the establishment of an Industrial School at Highgate, where all the girls were taught cooking and house work generally.

The CHAIRMAN—Do you not think it would be possible to prepare a catechism of cooking, or a few short, practical chapters, applicable to the condition of the poorer classes in this country, and which might be communicated to the upper classes before they left school without difficulty?

Dr. THUDICHUM—Undoubtedly. I have for a long time conceived the idea of preparing a little book, which might be called "The Spirit of Cookery," and which should contain the elementary principles of cooking.

The CHAIRMAN—What I should suggest would be a pamphlet of five or six pages, containing a few essential rules of cookery, applicable especially to the poorer classes.

Dr. THUDICHUM—Those rules would be very useful; but their execution would have to go hand-in-hand with a number of other practical improvements calculated to minister to the welfare of the lower classes. You have not only to give to them rules how to cook, but to put within their reach the necessary apparatus with which to cook, for the success of cooking is dependent upon proper apparatus for the purpose. No good and economical cooking can be done on grates as they are at present constructed. The introduction of a really practical and economical cooking apparatus for the poor would be a great boon.

Mr. CHESTER suggested that every good apparatus which was introduced might be tried in the first instance in the model lodging-houses, such as those founded by Mr. Peabody. He also suggested that a very useful charitable association would be one for the distribution of iron pots among the poorer classes.

Mr. C. WILSON—I would ask one question of Dr. Thudichum. Have you given any attention to the subject of the rate at which, running over the whole scale of articles suitable for diet, sufficient quantity could be purchased for a man in health to fill his stomach comfortably, as any one of us would do at an ordinary dinner?

Dr. THUDICHUM—He could probably do so at the cheapest rate upon bread and cheese.

Mr. E. WILSON—I presume you mean that that would be the lowest rate now, with the present limited choice of articles of food; but, supposing he had the whole range of diet available, and was educated in the proper preparation of food, would he not be able to fill his stomach with food cheaper than bread and cheese?

Dr. THUDICHUM—I am not able to answer your question off-hand; it is a subject that would require investigation.

Mr. E. WILSON—In the East various kinds of bulbs are eaten, cooked with a little fat. I am sure a meal may be made from them cheaper than with bread and cheese.

Dr. THUDICHUM—Possibly such forms of vegetable food might be imported with advantage, but we have cheese in this country, which they have not in the East; and the cheese, though taken in small quantity, affords an amount of nutriment which the other kind of food does not supply. I may add another consideration; no doubt, beans and peas, lentils and lupins, are a good kind of dried seed food, and cheaper than any other description; but when the question arises of producing them in this country the laws of agriculture interfere, and it is found that here it will not pay the farmer to grow anything except the best grain. Lupins would be the last resource of agriculture. Where the soil was insufficient to grow wheat and beans and peas you might grow lupins, because the roots of these plants strike deeply into the subsoil, and gain what nourishment there is there.

Mr. SHAW—Are there not vast extents of such land abroad, where they would be glad to grow such grains for exportation? and they might be grown in places otherwise unproductive, if the demand was sufficient to induce a large amount of cultivation.

Mr. READ—Dr. Thudichum has told us of the difference between the nutriment contained in tea and beef tea, will he be good enough to tell us the difference between the nutriment in malt liquor and beef tea?

Dr. THUDICHUM—The nutriment in malt liquor is greater than in beef tea; it contains alcohol, which is food. I will state the grounds on which I base that assertion. Last summer I performed an interesting experiment. I invited my class in pathological chemistry to meet me one afternoon in the gardens of the present St. Thomas's Hospital, formerly the Surrey Zoological Gardens. There were thirty-three in number, including myself. We drank, from two o'clock in the afternoon till seven in the evening, 44 bottles of wine, consisting of white and red Hungarian, Burgundy, and Sauterne. The wine had been previously analysed, and the quantity of alcohol it contained determined. The 44 bottles of wine, drunk by the 33

persons, contained, in the aggregate, 4,000 grammes of absolute alcohol. The whole of the urine passed by these people from two o'clock in the afternoon till six o'clock the next morning was collected and distilled. There were 24 distillations; and there were left, after the last distillate had been dehydrated, 10 grammes of alcohol, the rest having been burnt up in the system. Supposing that ten grammes more passed out with the breath and through the pores of the skin, it would give only five grammes out of every 1,000, or a-half per cent., as the quantity which was left unused by the economy. We have here a direct proof that out of the whole quantity of alcohol drunk only a quarter per cent. was excreted by the kidneys.

Mr. E. WILSON—Is it quite certain that all the alcohol that was retained was beneficially used up?

Dr. THUDICHUM—I have no doubt all was beneficially used up. I do not say that for a man to drink a bottle and a quarter of wine is beneficial to him, but I say this—that whatever alcohol it contains has a stimulating action, and, moreover, a warming action.

Mr. CRITCHETT—Against this experiment may be placed some investigations made by two French chemists, MM. Lallemand and Perrin, and supported by Dr. Edward Smith, tending to show that as soon as alcohol is taken it at once begins to pass off, through the skin and otherwise, perfectly unchanged.

Dr. THUDICHUM.—These experiments are quite inconclusive, as no estimation of the quantity of alcohol passing off had been made, which I regard as very small. Besides, alcohol contains sugar and gum. It also contains albuminous matters, which cause it to ferment; they are digestible. Then it contains phosphates in considerable quantity. The phosphates abound in fruit and grain, in bread, and in meat, and no doubt they are of great importance in the animal economy. Then there are in beer certain undefinable substances—the brown syrupy matter, which we cannot define. There is also acetic acid in beer, and the extract from the hops, which are, to a slight extent, narcotic, something like tobacco.

Mr. CHESTER—There is no nutriment in hops?

Dr. THUDICHUM—No; it merely has a soothing effect upon the brain.

The CHAIRMAN mentioned that the result of an experiment tried by a contractor with a number of navvies working at night at a tunnel, one gang being supplied with bread and butter and coffee, and the other with bread and cheese and beer, was, that the larger amount of labour was performed by the men who took the bread and butter and coffee.

Mr. E. WILSON remarked upon this that the men put upon the coffee regimen might not have confined themselves to that beverage, while with the others it might have been a question of an extra quantity of beer, and it would not be known what quantity of beer the men might have drunk in the day time.

Dr. THUDICHUM—There is no doubt whatever that alcohol drunk at certain times, in certain conditions of the body, takes off the edge of the understanding, and should not, therefore, be taken early in the day. On the other hand, if a man is tired from a morning's work, and has taken as much food as he requires, he feels a craving for something which more food would not supply, and that is given in alcohol.

The CHAIRMAN—What do you say to the particular experiment with the navvies which I have mentioned?

Dr. THUDICHUM—The experiment you have related it is impossible to judge of, for this reason—you do not know what the precise condition of those men was. You do not know what they had eaten and drunk the day before, and what they were accustomed to eat and drink. One set of men may have been accustomed to beer and the other to coffee. To one set of men it may have been so much extra beer acting upon what they had previously taken.

The CHAIRMAN—*A priori* do you assume, supposing the men to have been moderate in their previous living, that the bread and cheese and beer would be as good food for them as the bread and butter and coffee?

Dr. THUDICHUM—I have no doubt of it.

Mr. READ—Supposing a labouring man, whose chief diet was bread, were to drink a glass of beer, would that be a substitute for the meat which he could get for the same money?

Dr. THUDICHUM—It would be but a poor substitute. The nutritive value of the beer would be very small compared with that of the meat. If a man spent fourpence in beer he would not obtain half the nutriment he could get if he spent the same amount of money in meat.

(Dr. Thudichum, having received the thanks of the Committee, then retired.)

Mr. PHILPOTT, having been introduced to the Committee, stated that he had been in the habit of melting down 1,000 to 1,500 sheep per day, in Australia, for four months together, but he had tried in vain to discover any process by which the meat could be preserved for food, except, perhaps in the form of the extract. He had had great quantities salted but it did not succeed.

The CHAIRMAN—Supposing a means were discovered of preserving meat in a fresh state for many months, could such a supply be obtained from Australia and other parts, as would make the business commercially successful, and afford such a supply of meat as is required in this country?

Mr. PHILPOTT—An unlimited supply of the very finest quality of meat could be obtained. We only want the means of preserving it. Throughout the vast tracts from Victoria to Brisbane there are no means of disposing of the carcases except by melting them down.

The CHAIRMAN—You know of no means of preserving the meat so as to make it a useful and valuable article of export to this country?

Mr. PHILPOTT said he knew of none except Liebig's process, used by Mr. Tooth. If the extract of meat were made upon a very large scale, he thought it could be sold at half the present price in this country, seeing that a bullock cost only about £3 or £4 in Australia; but he could not state the quantity of extract which such a carcase would yield. At present the meat itself could only be preserved by salting it so intensely that people would not eat it in this country; and he was not aware of any means by which the salt could be extracted from the meat on its arrival here. Legs of mutton salted were sold at 3s. per dozen, and they were the finest quality of meat, but they had become hard by the salting. He believed if a process of preservation were discovered to enable meat to be brought from Australia or Buenos Ayres, in such a condition as would lead to its use in this country, it could be sold with profit to the producer at 2½d. to 3d. per pound.

CANTOR LECTURES.

"ON MUSIC AND MUSICAL INSTRUMENTS." By JOHN HULLAH, ESQ.

LECTURE I.—MONDAY, MARCH 4th.

HARMONY, &c.

Mr. Hullah, after briefly cautioning his audience not to expect a concert, to which the lecturer was to stand in the relation of programme; and professing his anxious desire to aid in the work of the Society of Arts, which he conceived to be to collect, cherish, and diffuse ideas, spoke of the music of the ancients, the nature of which the researches of scholars had been far from successful in revealing. He quoted a passage from Professor Blackie's "Homer and the Iliad," which showed, not so much what Greek music was, as what it was not—anything in the least like the music of modern times. Music as a self-sustained and self-contained means of addressing the senses and the intellect, is a new art, the youth of which had been witnessed almost by men living;—and not merely a new art but a new

science; for the "music" of the *Quadrivium* represents principles about which modern musicians give themselves no concern. This, in some respects is to be regretted. In the entire neglect, for instance, of Acoustics (once the principal part of music), musical performers, as well as composers, have possibly lost or delayed the discovery of many truths and first causes, which they alone have the organization, the opportunity, and, it might seem, the motive, to search into. From the separation of practical music from acoustics, improvements in musical instruments have been fewer and further between than in other branches of mechanical application; varieties occur in pianofortes, for which the makers are unable to account; and in the construction of rooms for musical performance, or public speaking, failure is at least as common as success. Possibly, however, as there are graces "beyond the reach of art," so there are truths out of the depth of science; but this need not prevent our cultivating the graces, and using the truths accessible to either. The first principles of the science of harmony are intimately connected with the first principles of the science of acoustics, and many things in the former are best explained—can only be explained—by the latter. The lecturer then, as a preliminary to the demonstration of this, proceeded to explain the cause of sound, and the qualifications necessary in order to make sound musical. The vibration of the air must be regular and sufficiently frequent, otherwise sound is not appreciable; on the other hand, if vibration be too frequent, its result will be inaudible. There are means of demonstrating the existence of sound beyond the reach of our organisation. The pitch of a sound depends on the number of vibrations communicated to the atmosphere by the body which causes it, in a second of time. There are many ways of ascertaining the number of these, one of the simplest and most easily explained being the invention of Mr. J. Henry Griesbach. A drawing of this instrument was then exhibited, and its action shown. A fourth part of a string, itself too long and heavy to make a musical sound, is isolated, and tuned to any pitch required. The entire string is then set in motion, and the pace of its vibrations being moderate (not exceeding eight or ten per second), they are without difficulty recorded on a paper wound round a cylinder by a pin attached to a spring, struck by the string at each successive vibration; another pin, connected with a seconds pendulum, marking the recurrence of each successive sound, and consequently the number of vibrations made in it. Mr. Hullah wished to draw especial attention to this and other similar instruments, because it is very commonly thought that evidence about pitches in different countries and times rested altogether on tuning-forks—instruments notoriously liable to injury and change. The fact that elevated sounds result from such prodigious numbers of vibrations is calculated to excite astonishment; not more so than another—that there is no such thing as a simple unmixed sound, or at least that no such sound can be maintained for more than an instant. The lecturer then proceeded to explain the nature of harmonics, and the construction of the harmonic chord, not for its own sake as a natural phenomenon, but on account of its bearing on practical harmony. Harmony is justified (if it require justification) by the harmonic chord, which proves that polyphony has its basis in nature. An elegant passage from Rousseau was quoted on the other side, but, happily, discussion on the comparative merits of harmony and melody is now practically useless. We cannot get rid of harmony if we would, and would not if we could. Mr. Hullah then proceeded to show that the relation of harmonics to their prime—the constitution of the harmonic cord, accounts for much that has long been universally accepted as true among harmonists—that had even been accepted by them, and practised empirically before that construction was understood; science in this, as in other cases, subsequently justifying art. From the harmonic chord we first derive the triad, and ascertain what notes within the limits of a common cord can be doubled or repeated in the octave,—hence, what is the relative importance or effectiveness of those notes. Again, the harmonic chord furnishes us with a general law for the arrangement of chords—having its largest intervals lowest, its smallest highest. Moreover, it is a combination in which the ear will not rest—in musical language, a *discord;* not a discord in the common literary or poetical sense, but a combination, of itself often beautiful, and always suggestive of continuity, sequence, or something to come after it. More than all, the harmonic chord includes always two sounds, the relations of which may be regarded as the first principle of modern harmony, and that which distinguishes modern music, more than any mere superficial difference, from the music of the 15th and 16th centuries. These two sounds are the 4th and 7th of the natural (or any like) scale, whose contact or neighbourhood alone reveals that scale, and whose resolution on the 3rd and 8th decides not only the scale but the *mode*.

The musical illustrations were exhibited on diagrams, as well as played on the pianoforte by the lecturer.

THIRTEENTH ORDINARY MEETING.

Wednesday, March 27th, 1867; Colonel W. H. SYKES, M.P., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Beaumont, Somerset, 144, Piccadilly, W.
Dunderdale, James, Tiverton-lodge, Cheetham-hill, Manchester.
Hopkin, W. K., 5, New Cavendish-street, W.
Hutchinson, Robert Hopwood, Tenter-house, Rochdale.
Karslake, Sir John B., M.P. (Solicitor-General), 50, Pall-mall, S.W.
Nield, Jonathan, Dunster-house, Rochdale.

The following candidates were balloted for, and duly elected members of the Society:—

Busbridge, Walter, 4, Chester-place, Plumstead, S.E.
Guise, Francis Edward, 2, Middle Temple-lane, E.C.
Ingall, Charles, Mellish's Wharf, Limehouse-end, Millwall, E.
Johnson, John Robert, 31, Red Lion-square, W.C.
Keating, Lorenzo, 231, New-cross-road, S.E.
Kernaghan, B., 70, Bishopsgate-street Within, E.C.
Oliver, Thomas, 66½, Northumberland-street, Newcastle-on-Tyne.

The subject introduced for discussion was—

STORM SIGNALS AND FORECASTS, THEIR UTILITY AND PUBLIC IMPORTANCE WITH RESPECT TO NAVIGATION AND COMMERCE.

BY CHRISTOPHER COOKE, ESQ.

The science of meteorology, or of weather knowledge, even when viewed irrespective of prediction, seems to be even yet in its infancy. The Egyptian geographer, Ptolemy, in the second century of the Christian era, wrote upon this subject, and he described the particular constituents of the atmosphere, the character of meteors, and what he deemed to be rules for predicting various atmospherical phenomena. Since his day various observers have studied this important subject, and some of them have published, in America as well as in Europe, the results of their labours; yet our present Astronomer Royal is reported to have declared at Aberdeen, so recently as September, 1859, that, "with respect to aqueous vapours and atmospheric waves, inquiries had only served to throw obscurity on the subject, and he regarded the science of meteorology as one of the most desperate with which we have to deal." Not many months have passed since I read a statement that Sir John Herschel disclaimed the unenviable title of

a weather-prophet; and an eminent French astronomer has expressed a similar opinion respecting weather wisdom, whatever may be the progress of science. The late Mr. William C. Burder, of Clifton, would not undertake to predict weather for more than twenty-four hours in advance; and even this mild state of prediction he would not venture to publish, while other meteorologists scout the idea of prediction entirely.

On the other hand we find there are various prophets, each conscious that his system is the best, and that it must prevail. A well-known writer upon predictive meteorology, Mr. W. H. White, the weekly London correspondent of the *Mark Lane Express*, observed, a few years since, with respect to these systems, that "first and foremost on the list stands Admiral Fitzroy, backed up by Government support and high patronage throughout the length and breadth of the land; but his predictions are limited to storm periods from observation alone, and hence his predictions are at short date, sometimes a few hours only, and at most twenty-four to thirty hours. Yet, even these enable him to send telegrams to most of the English ports to warn the sailors that a stormy period is at hand, by which means he has saved the lives of many brave seamen, and prevented the loss of much valuable property. This method, useful as it may be, does not furnish the most remote hint at the cause of the predicted storms thus signaled, and hence, whenever it shall please the God of storms to remove the admiral from among men, the theory of the cause of storms, forecast, will die with him, and man will still be as ignorant as before the admiral commenced his career—a grievous state of things, but true. Storms predicted by him did not come at all, while others came unpredicted, so no theory can be attached to such a course of prediction, notwithstanding that his system produced many important results."

Then there is the plan of comparing one season with another, yearly or by a cycle of years, carried on by the late Mr. Howard, by Mr. George Mackenzie, who paid much attention to the east wind, and by other observers. Mr. Thomas Plant, of Birmingham, makes his predictions by comparing one season with another one, and then he draws his conclusions accordingly; while the equinoctial theory, advocated by Dr. Kirwan during the last century, and recently by Mr. Thomas Du Boulay, has its admirers; and Lieut. Saxby, R.N., is a believer chiefly in the lunar influence. The astro-meteorologists, since the time when Admiral Fitzroy suggested that perhaps the astrologists of old were wiser in their generation, have taken the title of astronomic meteorologists, and they teach that the great changes of pressure, temperature, draught, moisture, electrical displays, heat and cold, are caused by solar, lunar, planetary, and cometary bodies, according to their respective lights and aspects, as they move through space, and form certain angles.

The Report of the Committee "appointed to consider certain questions relating to the meteorological department of the Board of Trade," dated in May, 1866, clearly explains the history and mystery of Admiral Fitzroy's occupation, as well as the results of his ill-understood but partially useful labours with respect to meteorology. Let all persons interested in this subject read and well consider that elaborate statement. I can only refer to it briefly upon this occasion. It appears that so long since as the autumn of the year 1851, Lord Palmerston's Government issued instructions to our British consuls to assist in the collecting of statistical information respecting atmospherical phenomena, in order to assist the investigation of storms, which was carried on by Colonel Reid; and this fact of itself proves that the subject has been deemed important by the British Government.

In 1852, Lieut. Maury, on behalf of the United States Government, collected various marine meteorological observations, and Sir John Burgoyne, British Inspector-General of Fortifications, contemplated some land observations, and suggested to Lieut. Maury that both schemes should be conducted on one plan. After some correspondence and delay, a conference met at Brussels, in August and September, 1853, which made suggestions respecting various meteorological instruments, and prepared a form of meteorological register, with instructions, to be used for observations at sea. In 1854, the Royal Society, in reply to a communication from the Board of Trade, made suggestions respecting the observations, but there was "no indication that it was a part of the functions of this department to publish undiscussed observations, or to speculate on the theory of meteorology, still less to attempt the prognostications of weather." Ten years since Admiral Fitzroy contemplated his system of forecasting weather, and five years later he reported that "by continued and consecutive series of charts, constructed on the simultaneous principle, an insight into the laws of our atmosphere, into meteorological dynamics, had been gained, which enabled us to know what weather will prevail during the next two or three days, and when a storm will occur."

At the meeting of the British Association, in September, 1859, at Aberdeen, "the Committee of the Section of Mathematical and Physical Science" having represented the probable importance of occasional telegraphic communication between a few widely-separated parts of Great Britain and Ireland, by which warning may be given of storms, the General Committee recommended an application to the Board of Trade for such an arrangement as might further the object authoritatively. Consequently, in the year 1855, Admiral Fitzroy, as an officer of our Government, and on behalf of the Meteorological Department of the Board of Trade—established at £4,200 a year—prepared an experimental plan for the conveyance of intelligence of approaching storms; and on the 25th February, 1860, the Council of the British Association ruled "that storms existing at one place should be telegraphed to other places; but they did not intend the elaborate system of foretelling probable weather that was subsequently adopted."

Admiral Fitzroy deemed his five years' data sufficient for the system of forecasts, and for predicting the weather generally. In 1860, 15 stations in the United Kingdom were appointed for receiving continental telegrams of weather through Paris, and for the daily communication there of our weather. In February, 1861, he first gave his weather warnings and storm signals, which, in August, 1861, were extended to 80 additional places, making 130 altogether; and daily forecasts of weather were gratuitously published in the London newspapers. These soon became popular, although opposed and derided by some persons. Foreign Governments were much interested in the system. The predictions were sent to Paris, and the system was adopted there and at Berlin, as well as in Russia, Holland, and Italy. Occasional warnings were sent to foreign countries by the English Meteorological Office. On the 5th June, 1860, the *Times*, in a leading article, had thus referred to the "shocking character of the wreck register. In 1859, 1,600 persons perished within sight and reach of our own coasts, while coming storms might be accurately predicted by barometers, which, with anchors, cables, and lifeboats, would be the means of saving many lives, provided that a central station, communicating by telegraph with distant parts of Ireland and Cornwall, could convey meteorological information to distant parts of Britain. That Admiral Fitzroy had supplied, for £4 each, a good barometer to thirty-three of the poorest, exposed British fishing villages." On the 26th June, the well-known "J. O." in the *Times*, stated that twenty fishing-boats had been lost recently, with all hands, on the Norfolk and Suffolk coasts, whereby 180 men had perished, leaving widows and children destitute.

On the 6th September, 1860, meteorological reports were published from fourteen places, and by telegraph from twenty-five places, respecting wind and weather. Shortly afterwards, the *Times* reviewed Admiral

Fitzroy's manual called "How to Foretell Weather," and published it in complete form, as a work of public importance. On the 11th February, 1861, the same journal recounted in one column the account of a north-east gale, and stated, "All the much frequented parts might have been warned three days before the storm. The late storm might have been predicted with as much certainty as an eclipse, and could have been announced by signals as conspicuous as fiery beacons, as all points of our coasts are connected by telegraph wires, and there can be no difficulty in showing signals. We think it highly desirable that the system should be established without delay. The destruction of human life and property on these occasions is so appalling that we cannot keep the subject too constantly before the public. Seamen do but share the common failing in neglecting the warnings of the barometer. These warnings have now been so deeply studied, and the information obtained has been reduced to a shape so practical and beneficial, that it would be deplorable if such advantages were thrown away. If some ports can receive timely information of a tempest, all can be similarly warned, and information should be published respecting the attention paid to them." On the 30th June following the *Times* stated that the general opinion was that the weather reports were valuable, and remarkable instances thereof had occurred. The same journal, on the 11th of April, 1862, observed, "The success already attained, and the practical good effected, justified the allowing Admiral Fitzroy to continue his experiments at the moderate cost they occasioned, for the storm drums obtained the faith they deserved, for seamen would no more like to go to sea when they were hoisted than on a Friday. He merely warns of danger—'look out; be on your guard; see to your glasses.' He has saved many fishermen's lives, and disseminated the knowledge of the use of the barometer. Even as a rain-prophet he need not be discouraged." There were some opponents and critics who doubted entirely the utility of the system, and amongst them may be named Mr. A. Smith, of Scilly, late M.P. for Truro; while other persons believed that the new system was partially beneficial at least, and would become more so.

According to the *St. Leonards Gazette* of the 3rd May, 1862, during the preceding months of March and April, out of Admiral Fitzroy's 59 predictions, 23 were successful; his opponents suggested that the law of chances would have used him better, but they should have remembered the assertion of Cicero, that he who has once predicted truly has a legitimate title to be deemed a prophet. Besides opponents, one of whom even in the year 1859, feared he would "not do much for the science of meteorology, being deficient in the elements, and on the subject of vapour in the air entirely befogged,—yet in search of the truth,"—sometimes he had to contend against anonymous triflers, whose false notices he contradicted, as upon one occasion, when official notice had been given from Lisbon of a severe storm to occur between 8th and 18th December, 1864, when the fishing boats returned in such alarm and haste that the nets were left at sea. Irrespective of this testimony to the credit which his system had obtained, I may select the following published verifications, amongst others not enumerated :—

Shields, 23rd February, 1861.—After the telegram of 21st, a storm signal was hoisted, when a very considerable fleet remained in port. About midnight, a hurricane of wind came on with a torrent of rain, and it continued to blow great guns for several hours.

13th March.—The signals at Liverpool arrived almost daily, and many maintained that the warnings of danger were of unquestionable benefit, resulting eventually in the saving of a great amount of life, and valuable property.

Shields, 19th March.—Furious gale followed a warning.

Shields, 11th January, 1862.—To-day we have another storm signal hoisted, indicating dangerous winds from the north. There is every prospect of a bitter night, as the wind chopped round nearly to the north, a severe gale threatening to increase in violence.

7th August, 1862.—Soon after the storm signals had been hoisted at the harbours and headlands of the British coasts on the 6th instant, the weather became unsettled, and there has been a succession of terrific squalls with torrents of rain.

October 13, 1862.—The storm signal had not been up for many hours before squalls broke over the coasts with much force. The signal to the seamen of the Tyne was "Look out for squalls." On the 17th another signal was followed by a similar storm, with sleet and rain. On the 12th, 13th, 17th, and 20th, signals were shown. On the 22nd, an alarming gale raged over London; and on the 19th of the month also at Yarmouth, rendering the masters of ships cautious in making all snug. Scarcely any part of the coast escaped the fury of the gale.

At Shields, on 23rd October, no sooner had the storm warning appeared, than the wind commenced to blow in heavy squalls. Some colliers would go to sea. Again, on 20th December, a gale burst on the coast immediately after the signal. In January, 1863, at Shields, early in the month the signal was followed by a storm, and at Swansea, on the 24th, another storm followed the signal. The same at Shields, where, on 14th May, a storm followed the signal again.

On 23rd July, 1863, the herring fishing boats took shelter in Whitby, having attended to the warning, which was followed by high wind. On October 1, at Shields, a gale followed with rapidity the storm warnings.

On October 16th, along the coast of West Cornwall, the storm of 12th and 13th raged with violence. A few shipping casualties occurred, but, "thanks to Admiral Fitzroy, and to those who have learnt in the school of experience, the smaller craft have found that forewarned is forearmed." Signal was hoisted the day before.

On October 30th, at Cardiff, the signal was followed by gales, continuing all day and night; also at Edinburgh, and elsewhere.

On November 1st, at Portsmouth, and again on the 4th, the signals were followed by dangerous winds. Signals for three days. "Internationally, there was then regular meteorologic correspondence from France, as soon as from Ireland and Scotland, at 10 a.m., when Admiral Fitzroy's notices arrived in Paris. The gale of the 1st and 4th November were signaled on the north and west coasts of France, and the west coast of Europe, in good time," wrote the Admiral on the 7th November.

On December 1st, at Shields, the signal of dangerous winds from opposite quarters, and on the 6th, at Portsmouth, the warning signals, were speedily followed by gales. On the 3rd, Mr. Thomas Plant stated in the *Times*, "the warnings of dangerous winds from opposite directions have been this week truly carried out in the results."

On 8th December, a great gale in the north of England was pointed out by the forecasts, and the director of the Paris Observatory mentioned the services rendered by the meteorological department carried on according to Admiral Fitzroy's principle.

In 1864, at Shields, on 11th January and 22nd January, and in North Lancashire on the 12th and 13th February, gales followed the hoisting of the signals there. In 1865, on the 11th January, at Shields, the storm-warning was followed by a gale, and again on the 22nd a similar result followed. In February, on the 13th, the west coast of North Lancashire was visited by gales, according to Admiral Fitzroy's telegram; and on the 15th a similar result followed at Portsmouth, where it was suggested that the signals should be repeated by means of the coastguard, as they would be of the greatest benefit to our mercantile marine, even at sea.

From Admiral Fitzroy's death, on the 30th April, 1865, until the 7th December, 1866, the signal and forecast system was continued at intervals with great skill by Mr.

Babington. During the last month of its existence, on the 7th, 12th, 22nd, and 29th of November, the cautionary signals were followed by storms and rough weather at and near the places warned. On the 3rd and 6th December, similar results followed the warnings, when they ceased by order of the Board of Trade.

Mr. A. J. Pearce, author of "Astronomic Meteorology," deemed the Admiral to be successful in forecasting storms 24, 48, or even 72 hours in advance, but on the approach of a northern gale the mercury does not fall, hence in such cases the warnings were too late, yet frequently useful to fishermen and coasting vessels. The Admiral admitted to this author, in the year 1864, that, believing the moon to be a great disturber by gravitation, while the sun is by heat chiefly, he was so far a lunarist, but he did not believe in astronomic meteorology. He believed a forecast to be the expression of probabilities and an experimental process, not a dogmatic prediction, and that some gales, especially from the north, came on suddenly and without warning, while in other cases the warning would extend over a space of several days. With respect to this remark, it should be remembered that fifty warnings, of 72 hours each, would extend over the whole winter, as the Committee have stated in their Report.

An Edinburgh critic of the forecast system stated that out of nine telegraph warnings sent there in October and November, 1864, only one arrived before the storm began, and one was a mistake. He was of opinion that if our station-masters desired to make genuine forecasts they must have two-hourly telegrams, sent directly from the west coast of Ireland, to be compared with their own barometers, although Iceland or the Isle of St. Kilda would be better, as in Britain we are too close upon the Atlantic to forecast storms for days before they arrive. He adds that Admiral Fitzroy's system, imperfect as it was, well deserved the expense of carrying it out. The fluctuations of the barometer were watched before boats put to sea. The hoisting of the drum had taught our sailors the value of meteorological science, and, so far, the practical fruits of the system were realised, which might be extended by means of the Atlantic telegraph. The *Daily Telegraph* of October 22, 1862, gave Admiral Fitzroy credit for having predicted the storm of 19th October, when the gale raged during the night with the energy of a hurricane:—"Yet, in the face of his 'cone,' hoisted apex downward, the Shields' colliers coolly put out to sea! It is impossible to deny that the Admiral's storm-cone has sometimes been hung peak uppermost when the provoking wind has come from the southward, and *vice versâ*. Can nothing be done then—has science nothing to say? Unforeseen disturbances, data not allowed for, may upset his calculations; but, as the field of meteorological inquiry is widened, and its deductions fortified, a very high degree of certainty will be obtained." The report of the committee upon the subject tends to confirm this idea.

In an explanatory note in the *Times*, 20th June, 1864—which journal, on account of the character of the science, if it could be founded, was disposed to make every allowance for the special cause of any occasional failure—which had brought discredit on his prophecies, Admiral Fitzroy disclaimed the title of prophet—"for they are not predictions." Forecast he deemed applicable to such an opinion as is the result of scientific combination and calculation, liable to be marred by an unexpected downrush of south wind, or by a rapid electrical action, not yet indicated to our limited sight. He explains, further, that inland situations are not affected by winds like the sea-coasts, Liverpool feeling chiefly the north-west and south-east winds; but the valley of the Severn is exposed to south-west and north-east winds. North-east winds are difficult to foretell, as the barometer rises before they blow, even with rain, and at such times the thermometer is a good guide. But in practice, many dynamic chemical and electrical considerations are indispensable, even for 48 hours, and on his barometers supplied to fishermen, these words were endorsed:—

"First rise after very low,
Indicates a stronger blow."

In the Report of the Committee, and in the letter contained therein, dated 15th June, 1865, written by the President of the Royal Society, the great value of the storm signals was recognised, for out of 56 opinions given in 1862 by shipmasters, 46 were favourable, 3 unfavourable, and 7 were neutral. From 1st April, 1863, to 31st March, 1864, 2,288 signals were hoisted, of which at least 1,188 were justified by the state of the weather when the message arrived or within 48 hours afterwards. That is, as to force of the wind, but with respect to its direction, about two were correct to one incorrect. Of the cautionary signals, between 1st April, 1864, and 31st March, 1865, out of 40 cases, 29 were successful, 8 failed with respect to force or direction, and 3 were late, being a decided improvement of the system. The following certificates, given in 1866, likewise testify to the value of the system:—

Aberdeen Marine Board:—"The utility of the signals was acknowledged, and the subject obtained more attention, they having been accurate for a considerable time."

Dundee Local Marine Board:—"Very generally appreciated; the correctness being a matter of common remark."

Shipowners' Society, South Shields:—"Of much practical value."

The Pilots, South Shields:—"Of great importance and practical value."

Mercantile Marine Office, Sunderland:—"Decidedly valuable. More correct than formerly."

Collector of Customs, West Hartlepool:—"More trusted by seafaring men."

Receiver of Wreck, Great Yarmouth:—"They are watched by seafaring men, and have improved in accuracy."

Collector of Customs, Deal:—"They have saved life and property to an immense extent."

Local Marine Board, Plymouth:—"Not in any great degree of value."

Mercantile Marine Association, Liverpool:—"Decidedly in favour of their continuance."

Local Marine Board, Liverpool:—"Very valuable; amount of accuracy has increased."

The committee, in their report, explained the manner adopted for making the forecasts, but the practice did not seem to be carried on according to definite rules, nor did the maxims appear founded on any sufficient induction from facts, the data not being enough for an accurate test; moreover it is difficult to compare the forecasts of one period with those of another. As a rule, they agree neither with each other nor with the storm warnings, and we do not know, the committee states, what weather will prevail during the next two or three days, and when a storm will occur. No good reason appears why a government department should issue them. With respect to the storm signals, the success has been greater, and, so far as they indicate the force of coming gales, they have been of some use, and their utility is widely admitted. They have improved, and probably are capable of greater improvement; but, with respect to the direction and force of coming gales, the warnings were not sufficiently correct to be useful. Ninety-five barometers had been supplied to fishing villages, when the committee issued their report, with instructions respecting their utility. The committee recommended that the system of telegraphing the weather be continued, but that the daily forecasts be discontinued; that the practice of issuing storm warnings be continued, but that no statement be made respecting the probable direction of the wind, nor warning issued unless the gale is expected within 48 hours. They credit the late Admiral Fitzroy with zeal and perseverance in establish-

ing the highly-prized systems of storm-warnings, and it will not be forgotten that he gave the first impulse to this branch of inquiry, and induced men of science and the public to take part in it, and who sacrificed his life to the cause which others may hope to advance.

In effect, since 7th December, 1866, the system has been postponed indefinitely, until the science of meteorology shall have been sufficiently perfected in the opinion of scientific men to justify its reappearance on the scientific stage, to receive, doubtless, a cordial welcome. Meanwhile, how about the fisherman's boy, and the three,—or it may be thirty,—or three hundred fishers who, in the absence of caution and of knowledge—the staff of mental life—may go out to meet death in the deep, deep sea? Shall the stormy winds "blow, and crack their cheeks"—with Death ready to launch his dart—at the victims, while we have a Greenwich Observatory, and many other observatories, a Royal Society, and other societies—a body of scientific men, and a Government with money—all looking on, and grasping at the shadow, while the substance is perishing for lack of the knowledge which, even now, these "masters in Israel" or guardians of *Salus Populi*, may be expected to supply? To quote the language of the *Daily Telegraph*—"Can nothing be done, then? Has science no good word to say for these gallant men and good ships (half of which are composed of colliers) to be caught in mid-course, and 'whelmed in the briny ocean?" The language, also, of the Royal Society's Secretary should be remembered:—"The proper test of the efficiency and usefulness of a system of cautionary signals at the different ports, is to be sought in the measure of utility which it appears to have attained; always remembering that the system can only be regarded as in its infancy; and its improvement, and, consequently, its importance, may be expected to be progressive from year to year."

The value and practical nature of the storm signals have been shown, and either in their original, or in a modified form, they should not be discontinued for twenty-four hours. But such discontinuance having occurred, it is suggested that, as is now the case at Kingstown Harbour—and perhaps elsewhere—the hoisting of a cautionary signal at each of our chief ports might be undertaken irrespective of the Government, as an affair of local management, temporary, and subject to local superintendence. For instance, when the barometer, which generally indicates the advent of great and dangerous storms, falls below 30in., and at a certain rate, say 3-100th an hour, a cautionary signal might be raised, and one of danger whenever the barometer falls at the rate of 5-100ths of an hour in all cases; the nature of the signals to be a question for future settlement.

Under present circumstances, it is submitted that a plan of the kind just mentioned by me would be respected by nautical people, and tend to preserve life and property, especially if such signals were shown by day and by night, if required, by means of lanterns, for it was Admiral Fitzroy's idea, that, in the case of warnings arriving after 3 p.m., they should be shown until late at night. Explanatory rules, if necessary, should be circulated. A writer in the journal which chiefly advocated the signal system, and which proved its national value, inquired, during a discussion upon its merits, "of what use is it to continue to read the barometer to the one-thousandth of an inch, and the thermometer to one-tenth of a degree, year after year, without the practical result gained by Admiral Fitzroy?" This question may now be fairly repeated; and it is for the Society of Arts, to whom I tender my thanks for allowing this discussion, as well as for those gentlemen present who understand the practical bearings of the subject better than I do, to consider the question herein offered for their earnest consideration, and to give independent opinions without favour and without fear—opinions which shall not be confined to this room, but shall be read far and wide, so as to show to the nautical classes of Britain that their welfare is not an object of indifference to the Council and members of this Society.

It has been stated recently, in the House of Commons, that in consequence of memorials from various seaports, including Liverpool, the Government has offered to supply telegraphic signals upon a request being made for that purpose, the expense to be defrayed equally between the contracting parties; yet, it may be that, bearing in mind the contingencies incidental to Government, the system for the present at least would thrive better if carried on irrespective of governmental patronage and aid. Probably, with respect to this part of the question, differences of opinion may be expected to prevail.

DISCUSSION.

Admiral OMMANNEY said he had heard the paper read with great interest, and he thought it a most valuable one in every point of view, practical and scientific. He trusted that the system adopted by the late Admiral Fitzroy would be resumed; at the same time he thought the department of the Government under which that system was carried out only went half way in what was required. There was, no doubt, great utility in the telegrams that were sent to the coast as warnings to the fishermen, masters of trading vessels, and others who had not received a scientific naval education; but another department was required, devoted to the physical geography of the sea, like that which was instituted by Lieutenant Maury in the United States. We had at present very little knowledge of the motions of the sea, the temperature of the ocean, the currents, &c. We required a department to give special attention to these subjects, and if the results of the researches were tabulated and published, ships would approach our coast with greater caution. The loss of life and property in vessels coming to our shores was probably not greater than that which occurred in vessels outward bound. He concurred with the opinions set forth in the paper, and he hoped they would have the full consideration of the meeting. He was decidedly favourable to the suggestion that barometers should be more extensively furnished to the places on the coast, inasmuch as during the period in which he acted as deputy-comptroller of the Coast Guard he had frequent opportunities of witnessing their utility, and he considered this one of the most practical measures that could be adopted. He thought it very advisable that a regular system of barometric observations should be carried out by the local authorities on our coasts.

Mr. ROBERT WILSON remarked that the system of storm signalling carried out under Admiral Fitzroy was, he supposed, instituted by the Government for good reasons, and he was at a loss to conceive on what ground they had been induced to discontinue it. If it had been an entire failure, that would, of course, be sufficient ground for its discontinuance; but the Board of Trade, who of course kept records of everything that was done in this matter, had failed to show that the proportion of correct forecasts to those which had failed was such as to justify them in giving up the system. If the Royal Society and the Board of Trade had finally resolved to have nothing more to do with it, he considered it was to the interest of the local authorities in the various seaports to take it up for themselves, in the way which had been suggested in the paper. Various systems had been alluded to on which weather prognostications might be made; but to foretell the state of the weather was one thing; to foretell storms was another. The approach of a great storm was generally indicated by the action of the barometer. He had been in the habit of watching that instrument very closely, and he could say he never knew an instance where the mercury fell half-a-tenth per hour without a great storm following. It might not

happen immediately upon the fall of the barometer, and alternate fall and rise might go on for some time, till some persons might imagine the storm had passed over. But it was sure to come at last. He had noticed that in several instances. He thought if the barometric changes were closely studied, every man might be his own weather prophet. He considered these observations might be carried out by local bodies without the necessity of the Board of Trade distributing expensive telegrams. If, however, the feeling was in favour of a central establishment, such an institution as the National Life-boat Association might employ some one conversant with the matter to telegraph to the coast, as the late Admiral Fitzroy did. Mr. Wilson concluded by making some suggestions for what, in his opinion, would be a more perfect system of lettering the barometer scale.

Capt. J. SELWYN, R.N., said that as in many climates with which he was acquainted the barometer did not rise and fall at all, as in others there were a number of different circumstances affecting the heights of the mercury at which the change from "fair" to "foul" took place, all empirical rules must be applied with reference to the special locality alone to which they were adapted. We need go no further than our own Westmoreland to find an abnormal state of things in this respect, and too much attention could not be given to this point. Admiral Fitzroy had done well in changing the marks on the barometer; he had certainly introduced a much better system. Anything which could mitigate the dangers of the sea was worthy of any amount of scientific inquiry. If one single life were saved, he maintained that the whole of the time and money spent would be well employed. At the same time he was not on the whole displeased that the Board of Trade, as a department of the government, and that the Royal Society, as a great scientific body, should have severally declined to continue to deal further with this question of storm signalling, for, in the case of the Royal Society, its funds were not subscribed for such objects, and in the case of the Board of Trade we had daily experience of the inefficiency of Government to deal with such matters. There were large money interests concerned in this question, and there were the association of Lloyds', and the maritime insurance companies, who might co-operate in carrying out such a system more advantageously than could be done by any Government board. It was asserted that, in many cases, the storms predicted by Admiral Fitzroy did not come, while others came unpredicted; therefore, it was argued, that no reliance could be placed upon such a system of prediction. Was there any new science that had sprung up which, within so short a time, had accomplished such important results with so few failures? Amongst the various reports upon this system quoted in the paper was one from Plymouth, which was not favourable, among many that were favourable, to the utility of the system. On that point he would observe that, as many storms touched Plymouth first, owing to its position, it was extremely probable that a signal which might prove of the utmost value on the north and north-east coasts would be of but little value at Plymouth, because it could not be sent in time to be of any avail. He was happy to see that the secretary of the Royal Society had given such admirable testimony to the truth of the principles which the Society declined to follow up—not because it did not take an interest in them, for that could not be supposed for a moment—but because it was not its province to deal with the matter practically. He would conclude by expressing a hope that this subject would not only receive special attention from scientific men, but would also receive money support from the public, who were so largely interested in the question.

Mr. VARLEY considered the great number of valuable lives which the system of storm signalling had been the means of saving was a sufficient justification for its continuance, and this could only be done efficiently by a complete system of telegraphic communication around the coast.

Mr. MAYER considered the arguments on this subject had not been put upon a fair basis. They were asked to discuss whether or not the system of storm signalling ought to be continued. His own opinion was that the Board of Trade, having organised a system of that importance, would not have given it up without strong reasons for so doing. It occurred to him that one reason why it was given up arose from the apathy with which the signals were regarded by seamen.

Captain TOYNBEE said that although he had accepted the appointment of Marine Superintendent of the Meteorological Department, with the object of obtaining more extended meteorological information from the sea, he had nothing to do with the issue of storm warnings, and wished it to be understood that the views he might express on this subject were those of a private individual, and not put forward in an official capacity. As a sailor he had naturally given a good deal of attention to the forecastings of the weather, and it had always struck him that the air which forms our south-west gales was that air which had come over the north-east trades into our latitudes, so that the weather which was first experienced in the south-west of Ireland would subsequently be the weather on the north-east. Therefore it seemed to him that something in the way of foretelling storms might be arrived at. For instance, supposing they took Valentia, then Greencastle, and Nairne, to the north-east, if telegrams showed that a depression had taken place at Valentia, a short time afterwards at Greencastle, and later still at Nairne, this would tend to show that a gale was travelling from the south-west. He drew a diagram, showing how these curves might be recorded for comparison, so that those for a month could be seen in juxtaposition. If these curves did not run parallel during gales, there would be reason to doubt the theory, and another classification of the ports might be taken—say, from south to north, or from west to east. He explained that the same diagrams might be used for temperature, direction, and force of the wind; but for exactness in this work better records were needed than could be collected from men not used to the work, without anemometers and wind vanes.

Mr. F. GASTER said, in witness of the measure of success which attended the labours of Admiral Fitzroy, he might bring forward the reports given in the paper read by Mr. Cooke; the absence of complaint from the different ports of the United Kingdom of the insufficiency of the signals; and last, though far from being least, he might refer to the very severe test which the system experienced at the hands of the committee of the Royal Society. Under those circumstances he thought the success of the system was undoubted. The Board of Trade requested the Royal Society to give their opinion as to the desirability of continuing the system, and the result was that the meteorological department was handed over to that society, which was the first scientific body in the country; and they were at perfect liberty to decline to carry on a system which they considered to be founded mainly on empirical rules. On this the Board of Trade declined to take the responsibility of continuing the storm signals, but what they proposed was that telegrams from various parts of the country should be collected and sent to the outports. He (Mr. Gaster) thought that method would be more efficacious than storm-signals sent from a central place to the various outports. He thought, if the telegrams were sent as proposed, that diagrams should be exposed to public view, showing the direction and force of the wind, together with the height of the barometer at each place. With such diagrams anyone could form his own judgment from the observations thus put before him. All persons present were aware of the very determined manner in which Admiral Fitzroy laboured to perfect his system of signals, but that there were failures occasionally could not be doubted. Con-

sidering, however, the difficulties that had to be experienced in any attempt of this kind, he thought the success attained was decidedly remarkable.

Mr. R. STRACHAN, as a meteorologist, and having studied the writings of Admiral Fitzroy on this subject, had come to the conclusion that the system was founded upon principles which had been best enunciated by Dr. Buys Ballot. It was impossible, however, under rules so vague and undefined as those which existed, to ask the Royal Society to undertake the task of predicting the weather. If definite rules, like those which guided the periods of eclipses, the rise and fall of tides, &c., were discovered applicable to this branch of meteorology, then he thought the Royal Society might fairly be asked to carry those rules into practice; but not otherwise. That Society having declined to take this task upon itself, a reasonable excuse was given to the Board of Trade for having adopted the same course.

Mr. PEARCE, as one who took great interest in the science of meteorology, was decidedly of opinion that the system of storm signalling should be resumed, although he thought it could not be carried out successfully without a central gathering power. It was no use to have different stations on the coast of England without a central collecting body; and when they saw such large sums contributed to the National Life Boat Association for the saving of human life, he thought the system of signalling to prevent men from imperilling their lives on the sea was a question of equal importance. With regard to the adverse criticisms that had been made by the public press and meteorologists on Admiral Fitzroy's predictions and storm signals, he thought it would be agreed that nothing had been advanced sufficient to deter them from the resumption of a system from which much good had resulted. With respect to the rules of Admiral Fitzroy being vague, that was the chief objection raised by the Committee of the Royal Society; but it was to be remembered that this had been the state of all sciences in their earlier stages. He thought those laws which were now regarded as empirical ought not to be wholly disregarded, seeing that they were applied with so much success by Admiral Fitzroy.

Mr. W. H. BONNEWELL argued, on the question of the utility and public importance of storm signals being continued by the Government, that if they were of the importance and reliability pointed out by the advocates of the system, an organisation like that of Lloyd's underwriters would be the first to adopt it for their own pecuniary interests, without waiting for any movement on the part of the Government. Under the circumstances, he thought the Government were justified in withholding their sanction to the expenditure of the public funds for carrying out these experiments.

Mr. LOCKHART called attention to the fact that from the Imperial Observatory of Paris there was every morning issued, by the head of that institution, the celebrated M. Le Verrier, a sheet map of the whole of Europe, on which the directions and forces of the wind on the previous day were recorded. The temperature and other circumstances of the weather were also given daily in that form. Seeing that these records were sold at a considerable price in this country, the question suggested itself to his mind whether something of the same kind might not proceed from our own Royal Observatory at Greenwich?

The CHAIRMAN, in closing the discussion, said it had been generally admitted that the storm signals of Admiral Fitzroy, communicated to the various outposts, had, to a considerable extent, been successful, and had, most probably, been instrumental in saving a large amount of life and property. With regard to the frequency with which they were correct as storm signals only, he held in his hand an extract from the report of the Committee, which had inquired very carefully into the subject. From this it appeared that of a total number of 405 storm warnings for the three years from 1862 to 1865, in the first year 80 per cent. were correct; in 1863-64, 68 per cent. were correct; and in 1864-65, 75 per cent. were correct. With regard to the direction of the wind, only 38 per cent. were right, and 62 per cent. were wrong. It therefore appeared that in the three years, about 75 per cent. of the storm warnings were correct. Whether scientific—whether empirical or not, was it not, at all events, a matter of prudence—a matter of humanity—not to hesitate about the continuance of such warnings? And yet they had been discontinued—and upon what grounds? There were scientific data—that was to say the results of observation; but it was alleged they were not sufficiently numerous or extended to enable a scientific man to arrive at definite results. But this was surely no reason why they ought not to continue these warnings which had been productive of so much good. After all, it could not be said that the science of meteorology was only just now in its infancy. He recollected Humboldt, who was his (the Chairman's) master, giving meteorological data at the end of the last century, laying down normal conditions which, for the tropics, to a certain extent held good. The Greenwich Observatory had records for half a century, made by scientific observers, and with the most carefully constructed instruments; and the same had been done by other bodies, such as the Cambridge, Oxford, and Edinburgh Observatories, to say nothing of the meteorological societies that had grown up within the last 20 years. There were as many as 72 regular observers in Scotland alone, and he believed about the same number in England. So far from not having sufficient observations, the difficulty was that they had too many. The truth was, however, that these observations had been made independently: they had not been brought together and compared. There had been no attempt to deduce normal conditions from the multitudinous observations made. It was not that they now wanted new stations to give them observations with self-recording instruments. If fifty years were not sufficient, how long were they to wait till they could use the results of these observations? Would the next six years be sufficient, when the last fifty years had not been so? As he had already said—these observations of Admiral Fitzroy produced a certain amount of good. As to the direction of the wind, no doubt they failed to some extent, but this could be explained on scientific grounds, into which he would not now enter. Capt. Toynbee had stated his views to the meeting, and these were in truth the very principles on which Admiral Fitzroy had acted. He (the Chairman) had always advocated extended observations not confined to localities. The British isles were far too restricted an area in which to obtain definite observations as to the conditions of atmospheric changes. The origin of these changes was far beyond that area. The great wave of pressure last year came from Shanghai, in China, where the barometer was at 31 inches, gradually progressing towards Europe, and travelling to America in a period of about seven weeks, as far as Montreal, when the barometer stood at 30 inches there. These were indications of atmospheric movements not over a space of 600 miles, but over the vast space of 16,000 miles. On the other hand, he had known instances of as great atmospheric disturbances as that he had mentioned occurring within so small a distance as 200 miles, in India. He had known the barometer to stand at 20 inches at Malabar, while at Coimbatore, only about 100 miles distant, it was at 30 inches. As he had said, he had always been an advocate for international observations, and he fully appreciated what was done in that respect in Paris by M. Le Verrier, as mentioned by the last speaker. Those daily bulletins were of the greatest scientific value. But this was not done in France alone, but was carried out throughout the whole of Europe—in Berlin, in Italy, in Holland, and in Russia an organised system of observations prevailed. He had a letter from the Secretary of the Meteorological Society of Scotland, expressing his deep regret and that of the

fishermen along the coast at the discontinuance of these storm signals. With regard to the daily meteorological observations published in the *Times*, he would say it required the experience of many years, and a considerable knowledge of meteorology, to be able to turn them to any practical account. With regard to the cost of carrying out the new system proposed, applying it to such a place as Leith, it would amount to about £60 per annum, half of which the Government offered to pay, but the town of Leith refused to pay the other half. It was suggested that an expert might be engaged at each station at £20 per annum, though what kind of expert could be had for that salary he was at a loss to conceive. This would bring the cost of the several stations proposed to about £1,600 per annum for the twenty daily communications, out of the pocket of the country. The establishment had already cost £10,200, in addition to £2,500 at starting. Observers in England would be aware that, circumstanced as we were with regard to the Atlantic, the wind blew from a westerly point 300 days out of the 365 days of the year; therefore, as far as England was concerned, we had the advantage of that normal condition apparently. It was remarkable that with a westerly wind, which came from a dry climate —such a one as we had had during the last week— the barometer stood very high. The wind gradually rose till it amounted to a gale, and there would be no indication of it on the barometer. That was also the case with the wind from the north; but with the winds from the other points of the compass, they had not that difficulty, and there was a greater chance of safety in the predictions. Considering the advantages which had already resulted from the storm signals of Admiral Fitzroy, and the practical inutility of the proposed system of observations confined to a few stations, he could not but hope that the Council of the Society of Arts would take the subject up, and express their opinion on it to the Government. The council of the Meteorological Society of Edinburgh had already done so, and they would see in a few days returns on the subject which would be published as a parliamentary document. Those returns would be made from Liverpool, Dundee, Edinburgh, Manchester, and many other places, and they would find there was an almost universal feeling in favour of the continuance of the system of storm signals. The Chairman concluded by moving a vote of thanks to Mr. Cooke for his paper.

The vote of thanks was then passed and acknowledged

PARIS UNIVERSAL EXHIBITION.

Scarcely four weeks separate us from the opening of the exhibition, and every day exhibits signs of increased energy and advancement. It will be satisfactory for those at home to know that the British section is not in arrear of its neighbours, in fact, taking everything into account, perhaps the English portion is more advanced than any other, with the single exception of Russia; the slow conveyance of goods from the coast is apparently the only circumstance which prevents still more rapid progress. If this be altered, there is little doubt that the British machinery court will be completely arranged by the opening day; if not, there will probably be large gaps, for which the French railway will be responsible. Unfortunately, this railway difficulty tells specially against England, the channel ports being invariably choked up when there is any important addition to the ordinary work.

The fears and doubts that have been expressed regarding the opening of the exhibition, or the condition in which it will open, never had foundation in fact. It was always intended that it should be opened on the 1st of April, and I do not imagine that it was ever for an instant contemplated to make any change in that respect.

The condition of the building is of course an important element in the case, and it is but fair to the Imperial commission to say that not only the stone and iron work, but also the glazing, painting, and flooring were all completely finished to time, that is to say, the progress of no portion of the exhibition has ever been impeded by the workmen engaged on the building itself; and to this fact may be added another, namely, that the floor is substantial and well laid, thus presenting a striking contrast with former exhibitions.

The grand vestibule is now being paved, and is probably finished at this moment, and before long its clerestory windows will be filled on one side with French, and on the other side with English stained glass; this vestibule forming the demarcation between the two countries.

Thanks to the change in the weather, the grounds are much improved in condition, and the main roads are becoming firm and hard; moreover, as the heaviest traffic is taken by the service railway, the roads have a fair chance of becoming consolidated. The service within as well as without the building is of immense use, and at the present moment there are three steam traversing and other cranes at work in the British department alone.

Even should the dry weather not continue, those who visit the Exhibition may now do so with perfect ease; the roofs forming the carriage entrance on one side of the grounds are completely finished, with the exception of decoration, and the roads beneath laid with asphalte, so that the entrance way is perfectly sheltered. The covered way, on the opposite side of the grounds, for those who arrive by railway, is also nearly completed; but the branch railway is not yet thrown open for passenger traffic, probably for fear of interrupting the goods service.

The further the preparations proceed the greater is the contrast between the British and the other portions, and especially the French section, of the exhibition; in the latter, not only are nearly all the courts covered with awnings, but the whole of the main avenues also, and that at no great height from the floor, so that the French and other industrial courts have the appearance of a series of narrow arcades, with back shops; in the English department, on the contrary, although a considerable number of large cases and stands are erected, they do not hide each other, and each has some distinguishing feature. But the course taken with regard to sun-blinds has produced a still more marked contrast. There will scarcely be any canopies in the whole of the English section, and instead of awnings, the Commission is placing a blind beneath each of the lights in the roof. These blinds have a small diaper pattern, and an ornament in the centre, containing, alternately, the insignia of the three kingdoms, of India, and the colonies, and, being carefully stretched and fixed to the woodwork, have a very neat and finished appearance. The awnings in the other portions of the building are, at present, brilliantly white, with gay coloured borders, while the English blinds seem to be unbleached; but, while the former offend, the latter please the eye. Thus, the whole British department is not only as free and open as possible, or nearly so—for there is one long wooden wall which interferes with the rule—but the ventilation is left without the slightest impediment overhead, an advantage which visitors will certainly appreciate highly four months hence.

Art manufacture promises to be better represented than usual in the British department. Besides the English house in the park, and the reproduction of portions of the South Kensington Museum, the progress of which attracts great attention, the terra-cotta columns of the building which is to surmount the boiler-house are now being erected, and look very graceful; and the art-manufactures court is taking shape under the care of Mr. Wood. There is no doubt that the specimens of ecclesiastical and general decoration will reflect credit on this class of exhibitors, amongst whom are the well-

known names of Blashfield, Pulham, Hart and Son, Harland and Fisher, Hardman, Jones and Willett, the Architectural Pottery Company, of Poole, Clayton and Bell, Maw, Skidmore and Minton.

The preparations in the Indian court are well advanced; the cases are all up and glazed, but they are sadly crowded, and even as they are there is said not to be nearly room enough for the collection.

The British colonies are also beginning to make themselves seen, under the care of Mr. P. L. Simmonds and some local representatives; but here the want of space is as usual the grand difficulty, and Australian natural history has migrated into the machine court. The birds are very beautiful, and would have formed such brilliant decorations elsewhere that it is a great pity to see them placed where they are. There is a want of fitness here which is disagreeable to the senses.

A musical section has been formed, and the art is to be represented from the triple point of view of composition, execution, and history. The following is the list of the committee for composition:—MM. Rossini, honorary president; Auber, president; Berlioz, Carafa, Félicien David, Georges Kastner, General Mellinet, Mermet, Prince Poniatowski, Reber, and Ambroise Thomas; Verdi and Gounod, secretaries; Lépine and Norblin, assistant-secretaries.

The ministers who are vice-presidents of the Imperial Commission, namely, the Ministers of State, of Agriculture and Commerce, and of the Fine Arts, announce officially that they will receive the members of the commission, and committees, jurors, and officials, foreign as well as French, on alternate Saturdays, commencing with the 9th inst.

Foreign functionaries must be presented by the commissioners of their country.

Fine Arts.

COLLECTIVE EXHIBITION OF INGRES' WORKS.—This exhibition is announced to open earlier than was originally intended, namely, on the 1st of April; and it is expected that a large number of the most famous works of the painter, especially those of his latter period, will be collected.

BUST OF THE LATE M. COUSIN.—The Emperor has commissioned Mr. Munro, the Scotch sculptor, to execute a bust of M. Cousin for the French Academy. Mr. Munro commenced the portrait of the deceased at Cannes, and took a cast of the face after death.

Commerce.

IMPORTS OF COTTON.—The imports of cotton last year were very nearly as large as in the great year 1860. Thus the receipts of raw cotton in 1866 amounted to 1,377,129,936lbs., as compared with 977,978,288lbs. in 1865; 893,304,720lbs. in 1864; 669,583,264lbs. in 1863; 523,973,296lbs. in 1862; 1,256,984,736lbs. in 1861; 1,390,938,752lbs. in 1860; 1,225,989,072lbs. in 1859; 1,034,342,176lbs. in 1858; and 969,318,896lbs. in 1857.

Colonies.

LAND TENURE IN NEW SOUTH WALES.—The eminent success (says a Sydney paper) that has attended the practice of free selection by small holders of land whenever the principle has been allowed unrestricted operation, has brought into greater contrast the desolating effects of the pastoral system as at present encouraged. The freehold cultivator converts his land into a productive garden, while the leasehold squatter suffers it to remain, for all purposes but those of feeding stock upon the natural grasses, a dreary wilderness. The constant answer to reproaches of this kind is that the squatters would improve the land if the legislature would give them secure and perpetual possession; and strangely enough this one-sided mode of reasoning finds supporters in persons who ought to be amongst the first to perceive its hollowness and injustice. There is no reason whatever why the public land should be secured to the present occupants. For twenty or thirty years, in some instances, those lands have been shut up from general competition, and the time is fast approaching when the public will insist upon its termination. When that time arrives, the true wealth of Australia will, for the first time, become generally known to the world, and prosperous farms and a numerous contented yeomanry will occupy the places of desolate sheep walks and scattered and migratory adventurers.

LEASING OF LAND IN QUEENSLAND.—The Queensland Parliament have passed a bill called the Leasing Bill. A great bar against the occupation of land appears to have been the sum demanded by Government as purchase money—£1 per acre. The purchaser was also compelled to fence in all the land within two years from the date of purchase, if taken for agricultural purposes. The new leasing bill enables the man who desires to take up land for any purposes, to do so on easy terms, and the condition of fencing the land is no longer insisted upon. Many persons would have desired the introduction into the bill of a clause making the clearing and cultivation of a certain portion of land one of the conditions of leasehold. This, however, was strenuously opposed by the squatters, who also endeavoured to have fencing made a condition binding on the leaseholder; in this latter point, however, they were defeated. The bill is a compromise, the squatters having yielded to the agriculturists the right to lease land on easy terms, but they have, at the same time, taken care so to frame the Bill that they will themselves be able to make use of this liberality without being obliged to devote any of the land to agricultural purposes.

Correspondence.

THE CAB QUESTION.—SIR,—Referring to the paper read, and the letters that have appeared in the *Journal*, respecting the street cabs of London, will you allow me to offer a few remarks. First, with respect to the cab fare. When the fare was settled at 6d. per mile, the proper method was arranged for settlement of disputed fares by the establishment of a book of fares, published "by authority." Now, there is no doubt that this is the proper way of settling this difficult point; but no sooner was the book of fares published than "cabby" found out the wrong fares in the book, and employed his friends to ride about in his cab and pay him the fares according to the book. Cabby summoned the rider, and had the distance measured, proving the book wrong; and this was repeated in so many instances of mistakes in the book, and at so many different police-courts, that the magistrates said the book could not be depended on, and so it has remained practically useless since. Now, the principle is a sound one, and the best and simplest reference in case of a disputed fare; and, in any fresh legislation on the subject, the book should be made "infallible," in this way: Every care should be taken in its compilation, but a clause should be inserted in the act relating to cabs that, for all the purposes of reference in case of disputes, the book published "by authority," whether right or wrong, should for the time being be held to be "infallible" and past question, and magistrates and police should be bound to enforce its decrees. After six months it should be revised, and a new edition published, with all its errors rectified (if any), and so on as often as required, the latest edition to be binding

on driver and rider for the time being. Secondly, as it is doubtful if the present fare of 6d. per mile will be continued, the book should show the distance in miles and fractions of miles, carrying change of fare. If the legislature fixes the fare (although on this point I am rather diffident), perhaps a fair sum between the cabman and the public would be 1s. for one mile and under, 9d. per mile from one mile to three miles, and 6d. per mile for all distances of three miles and upwards, the extra persons to be paid for and luggage as at present; but decidedly the law should allow a better class of vehicles to be licensed to carry passengers at a higher fare, such fare to be at the option of the owner of the vehicle, who would fix a rate which, while it would pay, would also induce the public to engage and use these conveyances freely. It has always seemed strange to me, seeing the extent of our parks and the beautiful drives we have in the immediate vicinity of the metropolis on all sides, that we have not plenty of open carriages plying for hire, as they do in Paris, to convey people for a moderate sum to the various points of interest or beauty within an easy drive of the bridges or the parks. Thirdly. Now I come to the principal reason that induced me to write this letter. We all of us know what a noble street we have in Holborn above Middle-row and Oxford-street, and how completely it is disfigured, and, for purposes of rapid and continuous traffic, how entirely it is ruined by the string of cab-stands, cutting up a fine wide thoroughfare into two narrow streets, offending the eye with its ricketty vehicles, the nose with its animal excretions, and the ear and the moral sense with its foul language. It is a disgrace to London that a cab-rank should be allowed to block up and hinder the traffic in its streets for a single day; and the remedy is so simple and so beneficial for all parties concerned—for the men, for the horses, and the cabs. They should be housed in stables, in the side streets, and kept manned and harnessed, only so many as required. The "waterman" should be stationed in the main street, in a box, with a red lamp lighted after dark, and a large number (the number of his station) printed on it. He should have an alarum communicating with the stables, and when a cab was wanted he should give, say, one pull for a four-wheeler, two for a hansom, and three for a superior vehicle; and, while the cab was coming, he should give a ticket with the number of his station to the hirer, ask him his destination, and, referring to his book, tell him the fare. In case of dispute at the end of the drive, the ticket would show the hiring-station. The whole arrangement should be placed under the care of the Metropolitan Board of Works, and the watermen should be efficient men, sworn in as constables, quite independent of cab-owners and drivers, and have a certain amount of control over them. There is no doubt that at present the cab-driver is dissatisfied, and the public is not well served, and therefore some change would be desirable for all parties.—I am, &c., A MEMBER OF THE SOCIETY OF ARTS.

THE GOVERNMENT AND THE TELEGRAPH.—SIR,—On the subject of telegraphy forming a part of our postal system, I hold nearly the same views as those set forth in the very able paper read last week by Mr. E. Chadwick. But there is one question of great importance, upon which (since it cannot be gathered from his paper) I shall, and probably many others will, be glad if that gentleman will state his opinion. Does he think that, either at the present time or in future years, it will be for the public benefit to prevent the dispatch of telegrams by private enterprise? or, in other words, would he wish the Government to monopolise the use of electricity for the purpose of conveying information of public importance, and of making our business or social arrangements? I cannot but think that any such monopoly ought not to be conceded; nor should we argue that because the post-office has given great satisfaction in its present capacity of administration only, it must be equally successful when it is called upon to undertake extensive and varied duties of construction. At any rate, the Government telegraph is likely to be more efficiently managed, and the adoption now and hereafter of the quickest and most correct means of telegraphic communication will be best assured by there being no prohibition of wholesome competition on the part of private companies. If it is asked, "What chance will a private company have in competition with the postal telegraph?" the undeniable force of such a question supplies the best argument in favour of there being no monopoly, viz., if the Government telegraph always keeps up with the public requirements, and avails itself of the best systems, it will have nothing to fear from any competition. The commercial success of any private company, its property being subject to local taxation, &c., &c., could be brought about only by want of care and capacity for adaptation on the part of the Government telegraph free from such heavy imposts. The public can gain nothing, but may lose much, by giving to the Government a telegraphic monopoly. Another thing to be considered is, that if the public grants no such monopoly, it follows that existing companies will not be—as they ought not to be—compelled to sell their rights and properties; and, if the shareholders of the different companies are not pleased with the Government offers for their lines, they can, and probably will, amalgamate their interests, thereby greatly diminishing the annual expenses, whilst they augment the efficiency of their working arrangements.—I am, &c., J. HAWKINS SIMPSON.

March 5.

THE POSITION OF INVENTORS AT THE PARIS EXHIBITION.—SIR,—As there existed some doubts as to the position of inventors exhibiting at the forthcoming Paris Exhibition, a letter of inquiry as to certain points was directed to the Minister of Agriculture, Commerce, and Public Works, by my correspondent, Mr. Dufrené, at Paris, to which the following is (the translation of) the reply, which you will no doubt consider of sufficient interest for insertion in your *Journal*.—I am, &c., L. DE FONTAINE MOREAU, Patent Agent.

4, South-street, Finsbury, E.C., 26th Feb., 1867.

(TRANSLATION.)

"Ministry of Agriculture, of Commerce, and Public Works,
"Paris, 21st February, 1867.

"SIR,—I have received the letter which you addressed me on the subject, first, of the importation, in view of the Universal Exhibition of 1867, of articles manufactured abroad and protected in France by a patent; and, secondly, of the protection concerning the rights in the inventions of exhibitors. On the first point, it is certain that foreign manufacturers with patents in France, who wish to introduce similar articles for exhibition, must first apply for authority from my Ministry, pursuant to the law of the 31st May, 1856, in order not to lose their patent rights. On the second point, there has appeared to be no objection to proceed in a similar manner to that of 1855. In consequence, a Bill has been drawn up to authorize the delivery of Certificates of Protection, and there is ground for hoping that its adoption will not meet with any difficulty.—Receive, sir, the assurance of my consideration.—The Minister of Agriculture, of Commerce, and Public Works (signed), FORCADE."

MEETINGS FOR THE ENSUING WEEK.

MON.....London Inst., 7. Mr. Macfarren, "On the Origin and Development of the Lyrical Drama."
R. Geographical, 8½. 1. Admi. A. Butakoff, "The Delta and Mouths of the Oxus." 2. Lieuts. Smith and Harrison, "A Journey to the Sources of the Sutlej."
British Architects, 8.
Society of Arts, 8. Cantor Lecture. Mr. John Hullah, "On Music and Musical Instruments."

TUES ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Discussion upon Captain Tyler's paper, "On Steep Gradients and Sharp Curves on Railways;" and (time permitting) Mr. W. A. Brooks, "Memoir on the River Tyne."
Photographic, 8.
Ethnological, 8. 1. Mr. J. Lamprey, "A Contribution to the Ethnology of the Chinese." 2. Hon. George Campbell, "On the non-Hindu Tribes of the Borders of Hindustan."
Royal Inst., 3. Rev. G. Henslow, "On the Practical Study of Botany."

WED ...Society of Arts, 8. Mr. Clements R. Markham, "On the Tinnevelly Pearl Fisheries."

Graphic, 8.
Microscopical, 8. 1. Mr. W. W. Whitney, "On the Changes which accompany the Metamorphosis of the Tadpole, in reference especially to the respiratory and sanguiniferous systems." 2. Dr. Mackintosh, "On a Gregarine form Parasite." 3. Mr. Lobb, "On a New Form of Paraffine Lamp."
Literary Fund, 2. Annual Meeting.
R Society of Literature, 4½.
Archæological Assoc., 8½.
THUR ...Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Syro-Egyptian, 7½. Mr. Bonomi, "On the Harmony between the Mosaic and Egyptian Cosmogony."
R. Society Club, 6.
Royal Inst., 3. Prof. Frankland, "On Coal Gas."
FRI .....Philological, 8.
Royal Inst., 8. "On the Traces of the Early Mental Condition of Man."
Statistical, 4. Annual Meeting.
R. United Service Inst., 3. Lieut. H. M. Hozier, "The recent Campaign in Bohemia."
SAT .....R. Botanic, 3½.
R. Inst., 3. Prof. Frankland, "On Coal Gas."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 25th February, 1867.

32. Bills—Land Contracts (Ireland).
38. ,, Sale and Purchase of Shares.
42. ,, Church Rates Regulation.
51. ,, Counsel to the Secretary of State for India.
6. Witnesses (House of Commons)—Return.
11. Municipal Boroughs (England and Wales)—Returns.
22. Public Debt—Account.
58. Greenwich Hospital and School—Estimate.
72. Freemen—Return.
74—56. Municipal Rates and Franchise Acts—Lords' Report (1859).
77. Civil Services—Statement of Excesses.
78. Committee of Selection—First Report.
82. Boroughs (England and Wales)—List.
Education—Revised Code.
Public Petitions—Third Report.

Delivered on 26th February, 1867.

33. Jamaica—Extracts of Correspondence on the Conduct of Military Officers.
60. Ecclesiastical Establishment (West Indies)—Return.
67. Elections—Return.
69. Terminable Annuities—Account.
73. Railway and Canal Bills—First Report.

Delivered on 27th February, 1867.

36. Navy (Education and Religious Denominations)—Statistical Return.
51. Bunhill-fields Burial Ground—Correspondence.
76. Queen Anne's Bounty—Account.
80. Public Health and Local Government Acts—Returns.
Lancaster Borough Election—Report of Commissioners.
Public Petitions—Fourth Report.

SESSION 1866.

524. Union Assessments—Return.

Delivered on 28th February, 1867.

47. Bills—Court of Chancery (Ireland).
52. ,, British North America.
53. ,, Attorneys', &c., Certificate.
54. ,, Hypothec Abolition (Scotland).
55. ,, Metropolitan Improvements.
56. ,, Thames Embankment and Metropolis Improvement (Loans).
58. ,, Trades' Unions (amended in Committee).
35. Metropolitan Board of Works—Account.
37. Naval Prize Money, &c.—Account.
68. Church Rate Bills—Return.
78. (1.) Committee of Selection—Second Report.
Education (1867)—Revised Code (corrected page).
Fortifications (Dockyards, &c.)—Report respecting Progress.

Patents.

From Commissioners of Patents' Journal, March 1st.

GRANTS OF PROVISIONAL PROTECTION.

Advertising—3443—J. H. Johnson.
Axles, mounting wheels on—377—C. W. Dixon.
Bricks—403—W. Clark.
Bricks, &c.—151—R. Kunstmann.
Cisterns, regulating the supply of water to—383—G. H. Kidd.
Embankments—387—E. Manico.
Fancy weavings, producing—373—E. Heywood and E. Hinchcliffe.
Fibrous materials, preparing, &c.—216—J. Taylor.
Fire-arms, breech-loading—222—J. W. P. Field.
Fire-arms, breech-loading—355—W. Kilbee.
Fire-arms, breech-loading—395—F. Bacon.
Fire-arms, ordnance, and projectiles—399—A. J. Paterson.
Flax, &c., pulling—228—G. Haseltine.
Games—180—T. Taylor.
Gas burners—363—D. N. Defries.
Grain, cleaning—405—S. D. Mack.
Hats, &c., pressing and shaping—345—S. Howard.
Horse shoes—381—R. B. Mulliner.
Hot water, heating with—349—H. K. York.
Iron piles and columns—401—J. Westwood and R. Baillie.
Leather straps, &c.—357—M. J. Haines.
Matters. preserving—379—W. Clark.
Metals, boring and planing—361—H. A. Fletcher.
Motive power—393—W. Clark.
Nails and spikes, forging—271—D. A. Halket.
Photographic portraits, taking—407—W. E. Newton.
Piled fabrics, finishing—3194—J. M. Worrall.
Rag-grinding machines—3378—J., W. S., and J. Rhodes.
Railway level crossings, gates on—369—G. Daws.
Saws—351—W. Clark.
Self-acting safety gun locks—367—J. Stanton.
Slide valves—343—W. G. Beattie.
Spelter—337—J. Graham.
Steam engines—397—H. H. Grierson and J. McElroy.
Steam, generating—375—J. Bührer.
Steam rollers—347—W. T. Carrington.
Type, locking up—353—W. Conisbee.
Vegetable substances, treating—385—W. E. Newton.
Vessels, drawing liquids from—409—H. A. Davis and S. J. Salkeld.
Vessels, &c., propelling—3262—R. B. Boyman.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Boat-detaching apparatus—464—G. Haseltine.
Files—465—W. R. Lake.
Furnaces, consuming smoke in—454—W. Harrison.
Gas, letting on, &c.—463—G. Haseltine.

PATENTS SEALED.

2161. J. A. Coffey.
2178. J. Booth.
2257. R. Frost.
2267. E. Russ & H. & E. Hammond.
2269. E. Nelson.
2272. C. Reeves.
2275. G. Lowry.
2276. E. Farr and I. Gregory.
2277. W. T. Sugg.
2278. T. G. Webb.
2283. H. Robins.
2285. A. V. Newton.
2292. J. Bullough.
2294. T. Berney.
2296. C. D. Abel.
2301. C. Defries.
2306. E. T. Hughes.
2311. C. Hodgson and J. W. Stead.
2314. C. T. Burgess.
2315. F. Warner, W. Stewart, and G. W. Barber.
2336. W. E. Gedge.
2503. E. B. Bigelow.
2622. J. Syme.
2710. E. B. Bigelow.

From Commissioners of Patents' Journal, March 5th.

PATENTS SEALED.

2288. W. Cuthbert.
2293. G. V. Fosbery.
2295. A. H. Hart.
2297. J. and J. W. Asquith.
2308. C. Catlow.
2312. C. E. Brooman.
2351. W. Clark.
2373. T. Newey.
2383. E. Wall.
2392. J. Thompson.
2406. E. Barlow and W. N. Dack.
2428. R. Richardson & J. Imray.
2436. I. Dimock.
2680. H. Kessler.
2769. N. H. Loomis.
2770. N. H. Loomis.
3273. C. E. Brooman.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

497. F. Weil.
515. E. T. Hughes.
541. G. P. Harding.
547. W. E. Newton.
505. S. Cooper & J. M. Worrall.
504. J. Chapman.
527. G. Gaze.
532. J. Wright.
550. M. Henry.
671. W. S. Longridge.
551. S. Bourne.
552. A. Manbré.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

527. T. Silver and J. Hamilton.
546. G. Weir.
578. H. Bessemer.
600. J. H. Johnson.
589. W. G. Ramsden.

Registered Designs.

The Notched Fire-place—February 5—4841—L. Banks, 36, North-street, Hackney.
Screw-wrench or Spanner—February 11—4842—J. Asbury, Balsall-heath, near Birmingham.
Bracelet Closer—February 18—4843—T. Davison, 2, Poland-street, Oxford-street, W.
A Coat-pocket—February 27—4844—S. Lichthem, 40, York-street, Cheetham-hill-road, Manchester.
A Portable Bookstand, with Slide Holder—March 4—4845—J. A. Fussell, 45, Woodstock-street, Birmingham.